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(54) **Enhanced uplink modulated backscatter system**

(57) In accordance with the present invention, a novel Time Division Multiple Access (TDMA) duplex radio communication system comprises an Interrogator which generates a first radio signal by modulating a first information signal onto a radio carrier signal. The Interrogator transmits the first radio signal to at least one remote Tag of the system. The remote Tag receives and processes the received first radio signal. The remote Tag then modulates a second information signal onto a second radio carrier signal to form a second modulated signal. This second modulated signal is then transmitted, in a time-slotted manner, back to the Interrogator. The remote Tag selects, or is instructed, how many times it should repetitively transmit the second modulated signal; and selects, or is instructed, over how many of the time slots following receipt of the first radio signal

the remote Tag should repetitively transmit the second modulated signal. Other embodiments of this invention include the use of Modulated Backscatter to transmit the second modulated signal, and the use of homodyne detection to demodulate the second modulated signal. A Frequency Division Multiple Access (FDMA) duplex radio communication system embodiment utilizes multiple subcarrier frequencies and another embodiment combines the FDMA and the TDMA methods. A Code Division Multiple Access (CDMA) embodiment utilizes multiple spreading codes; in addition, another embodiment combines the CDMA and the TDMA methods. A novel method for power control of the tag, using modulated backscatter, is also disclosed. Finally, a method for the Interrogator to instruct the Tag to dynamically alter the data rate of the second information signal is also disclosed.

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## EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 8726

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	WO 93 15561 A (INDALA CORP.) * page 7, line 3 - line 9 * * abstract; figures 1,2 * ---	1,6,8	G01S13/82
A	US 5 020 056 A (CHENNAKESHU) * abstract; figures 1A-1C * * column 3, line 34 - column 4, line 4 * ---	1	
A	US 4 471 345 A (BARRETT, JR.) * abstract; figure 7 * * column 5, line 63 - column 6, line 4 * * column 17, line 46 - line 67 * ---	1,12,18,21	
A	EP 0 270 274 A (MERIDIAN MICRO-SYSTEMS LTD.) * abstract; figure 1 * ---	19	
A	EP 0 324 564 A (SONY CORP.) * abstract; figures 3,7 * * column 4, line 49 - line 54 * * column 5, line 11 - line 20 * ---	2	
A	EP 0 177 094 A (PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LTD.) * abstract; claims 1,2 * ---	19	
A	US 3 984 835 A (KAPLAN ET AL.) * abstract; figure 1 * ---	20	
A	EP 0 685 825 A (BRITISH TECHNOLOGY GROUP LTD.) * abstract; figures 6,7 * * claims 2,3 * ---	21	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
BERLIN		26 June 1997	Danielidis, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



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### CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

### ☒ LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-8,19-21:  
Tag responding repetitively with dynamic length of time slot.
2. Claims 9-14:  
Tag capable of generating a set of subcarriers and selecting a particular one out of this set.
3. Claims 15-18: Tag creating spreading codes

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respects of which search fees have been paid, namely claims:
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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# EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 8726

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	WO 92 17947 A (MAGELLAN CORP.) * abstract; figure 3 *	9,15,16	
A	*Idem*	10,11	
Y	WO 89 05549 A (MAGELLAN CORP.) * abstract; figures 3A-4B * * page 9, line 27 - line 33 * * page 10, line 36 - page 11, line 4 * * page 15, line 10 - line 25 *	9,15,16	
A	*Idem*	10,11	
A	EP 0 420 180 A (NIPPON SOKEN, INC.) * abstract; figure 2 *	13,14,17	
A	US 5 144 314 A (MALMBERG ET AL.) * abstract; figures 5,8-10 *	12,18	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US 5 349 355 A (LONGAS ET AL.) * abstract; claim 1; figure 3 *	12,18	
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 26 June 1997	Examiner Danielidis, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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